

GIVE ME A KIBS: Policy instruments mediating the relationship between service knowledge firms and sustainable manufacturing supply chains

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ABSTRACT

Purpose: This study seeks to evaluate the mediating role of policy instruments in the the relationship between KIBS and employment creation in new manufacturing businesses.

Design/methodology/approach: The data used in this study come from three different sources. First, information on both the knowledge-intensive orientation of the entrepreneurial activity and the employment created by new manufacturing firms is obtained from the Global Entrepreneurship Monitor (GEM) datasets for Spanish regions. This information source is robust at it contains more than 176,000 observations. Second, data dealing with policy instruments—the stock of manufacturing firms and the total number of freights transported—were obtained from Eurostat databases. Third, macroeconomic variables were obtained from the Spanish Institute of Statistics. Data from the three sources allow us to build a panel dataset including the 17 Spanish regions during 2006-2012, which totals 119 region-year observations.

Findings: The results strongly suggest that building rich and diverse manufacturing business environment and appropriate infrastructures mediate the relationship between KIBS and the sustainability of manufacturing supply chains. The work offers implications for academics, policy makers and practitioners.

Originality/value: This research fills an important gap on servitization literature focusing on ‘when’ and ‘how’ new manufacturing businesses—which cannot internalize service offering—outsource those activities to Knowledge Intensive Business Service firms (KIBS).

Key words: KIBS, sustainable supply chain, entrepreneurship, policy instruments.

1. INTRODUCTION

In enhancing their competitive advantage manufacturers have shifted their focus from products to integrated solutions, including both products and services (Matthyssens and Vandenbempt, 2008; Baines and Lightfoot, 2013). Vandermerwe and Rada (1988) dubbed this business model servitization. The anticipated benefits of servitization approaches include more stable revenues, profitability, and corporate growth (Smith et al., 2014). Yet, servitization is a complex process, and positive results cannot be guaranteed (Neely, 2008).

Certain aspects dealing with the level of analysis, the type of organization, and the characteristics of the analysed services dominate mainstream literature on servitization. First, existing studies mostly examine the servitization phenomenon from a microeconomic perspective. Despite administrations in the US and Europe acknowledge the potential transformative power of service innovation (European Commission, 2011), the analysis of the territorial impact of servitization processes based on meso or macro approaches remains, to the best of our knowledge, empirically unaddressed. Existing literature is also silent with regard to the role of public policies in encouraging the development of service-oriented strategies among firms as a driving force fuelling sustainable territorial performance. While research on the policy mix of innovation and competitiveness is growing (Magro and Wilson, 2013), there is little explicit analysis of how these policy mixes might relate to servitization processes at regional or national level.

Most literature on servitization has focused on the integration of product-service portfolios within the same organization, but there is a dearth of research on businesses that do not have internal resources, such as SMEs or new manufacturers. In this sense Arnold et al. (2014) found that developing an appropriate service sector (i.e. finance, consulting) has been a key driver for the massive increase of manufacturing competitiveness in India. This reinforces the idea that service provision does not need to be integrated within organizational boundaries; and that territories can

benefit from the development of service sectors. In our case we assess how the knowledge intensive business firms in Spain (KIBS) helps to enhance the competitiveness of the new manufacturers.

The remainder of the paper is structured in four parts. First a theoretical background is introduced leading to the statement of hypotheses and a model plot. Second, the method is described drawing upon the combination of different datasets, including the 17 Spanish regions for the period 2006-2012, which totals 119 region-year observations. Results are presented in part three. Finally, the fourth part presents the conclusions and implications.

2. THEORETICAL UNDERPINNING AND HYPOTHESIS DEVELOPMENT

From a strategic management perspective, the business model is the essence of an organization's strategic approach and refers to the design of the value creation, delivery and capture mechanisms employed by the business to attract customers to pay for value and convert payment to profit (Teece, 2010). The primary objective of this paper is to scrutinise the economic impact—in terms of employment creation—resulting from the integration of advanced services into manufacturing processes. The successful implementation of this business model will highly depend on the organisation's internal resources.

In theoretical terms the proposed analysis matches the resource-based-view of the firm (RBV), which posits that businesses develop different competitive advantage—using their access to resources and capabilities—and this explains performance differences among competing firms (Teece, 1980). In this well-established framework resources are transferable while capabilities (or the way are combined and transformed) remain inside the organisation and hence cannot be transferred. This implies that manufacturing firms may not have the necessary resources to internally develop a servitization strategy, thus making the acquisition of those resources from the market—i.e., outsourcing—a desirable alternative. New manufacturing firms are exposed to liability of both smallness and newness, thus the internalisation of service activities in their value chain through KIBS might prove itself an optimal solution to develop these services.

Muller and Zenker (2001) describe KIBS as professional services firms providing knowledge-based and high intellectual value-added services mostly to other small and medium sized manufacturing firms. One example of the knowledge provided by KIBS is the management of large samples of digital information, namely big data. According to Opresnik and Taisch (2015) this information adds significant value to manufacturers offering especially in B2B relationships by providing customers with tools that can be used to enhance cost saving policies and develop more informed strategic decision-making processes.

Innovations with high consumer value perception stimulate new demand and enhance the generation and retention of rents. Those processes require a clear understanding of the consumer (O'Cass and Ngo, 2011) and in manufacturing settings consumer engagement depends on the degree of service provided (Spohrer and Maglio, 2008). Small and medium manufacturers do not have the internal capabilities and knowledge to incorporate advanced services into their value chain, and they need the collaboration and co-production of KIBS in those processes (Lessard, 2014). This means that the vigour and sustainability of the manufacturing supply chains may depend on the presence of knowledge intensive services available in a reasonable geographical proximity. We construct our first hypothesis based on this statement.

Hypothesis 1: Knowledge intensive business services will have a positive impact on the sustainability (in terms of employment) of new supply chains.

However, value creation to customers may not be directly linked to the process of value or rent appropriation. For SMEs specific external conditions facilitate the retention of those rents in the long-run, which are by definition set outside the business boundaries. Indeed, literature concerning innovation development within SMEs has traditionally paid attention to the role of public policies. But, what public policies are we talking about?

Recent literature has identified two different policies that boost innovation among SMEs. First, science and technology policies which include R&D incentives and human capital development (Parrilli and Elola, 2012). Second soft policies enhancing the interaction and collaboration between firms operating in the same sector, or at least participating in the same supply chain (Aranguren et al., 2014). We do not neglect the validity of those public policies in enhancing product development and productivity, but we understand that other policy instruments are more relevant when the goal is the value co-production of KIBS and manufacturers and the subsequent generation of employment. In particular, we seek to analyse the mediating role of manufacturing environments and transport infrastructure.

Vigorous manufacturing environments imply the existence of agglomeration economies. Increased competition and the availability of more suppliers and customers produce a learning effect, which has a direct effect on firm productivity, and thus on business sustainability (Andersson and Lööf, 2011). In addition, the improvement of public infrastructures have been linked to economic growth (Munnell, 1992), and this is especially relevant for manufacturing firms whose activities rely on transport systems to access local and international markets for both acquiring specific inputs and selling their products (Rodrigue et al., 2013). Overall, we hypothesize that the manufacturing environment and transport infrastructures provide opportunities for the successful engagement of KIBS and new manufacturers. All empirical relations are shown in Figure 1.

Hypothesis 2: Policy instruments, measured as the manufacturing environment and the transport infrastructures, positively mediate the relationship from knowledge intensive business services to the sustainability (in terms of employment) of new supply chains.

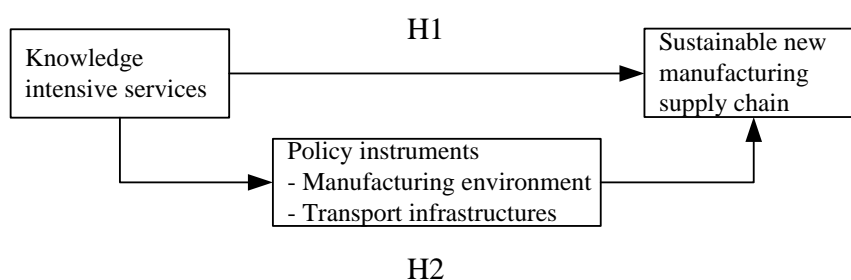


Figure 1: Research model

3. DATA AND METHOD

The data used in this study come from multiple sources. First, information on both the knowledge-intensive orientation of the entrepreneurial activity and the employment created in new manufacturing firms at the regional level were obtained from the Adult Population Survey of the Spanish Global Entrepreneurship Monitor (GEM) during 2006-2012. The GEM project began in 1998 as a joint initiative of the London Business School and the Babson College to create an international entrepreneurship research network. Today, more than 70 countries take part in this research initiative, making the GEM project a world reference in the entrepreneurship field and a highly valued source of information for academics and policy makers. A comprehensive description of the GEM project and its methodology is presented in Reynolds et al. (2005).

In the case of Spain, the survey was conducted in each of the Spain's 17 Autonomous Communities by a leading professional market investigation and public opinion service firm selected and monitored directly by the International GEM Consortium. The sample was built based on a multiple stage sampling method using the Bellview Fusion computer-assisted telephone interview system. In the first stage, a random selection of municipalities was collected according to population quotas. In the second stage, telephone numbers corresponding to the different municipalities were randomly obtained from the annually updated 'España Office v5.2' database of fixed and mobile telephones. Finally, individuals aged between 18 and 65 inclusive were randomly selected by the

mentioned software. The final sample used to reach the aim of this study contains 176,609 observations from Spain between 2006 and 2012.

Second, macroeconomic figures—unemployment rate and Gross Domestic Product (GDP) per head—were obtained from the Spanish Institute of Statistics. In the case of the GDP per head, values are expressed at constant 2012 prices and are deflated with respect to inflation. Third, data on the variables related to the configuration of the industry, stock of manufacturing firms and the total number of freights transported by air, road and maritime means were obtained from Eurostat.

Data from the three consulted information sources allow us to build a panel dataset including the 17 Spanish regions for the period 2006-2012, which totals 119 region-year observations.

The relevant variables for the empirical analysis are employment creation in new manufacturers as a measure of ‘sustainable new manufacturing supply chain’; and the proportion of KIBS over total number of new companies in each region as a proxy measure of ‘knowledge intensive services’. Policy instruments are measured with the stock of manufacturing firms and the freights transported. Table 1 provides summary statistics for these variables.

Variable	Mean	Std. dev.	Minimum	Maximum
Rate of KIBS business formation	0.1951%	0.2622%	0.0000	1.7081%
Employment of new manufacturing firms	3.0626	2.2533	0.0000	14.2857
Stock of manufacturing firms	12,718.39	11,497.44	2,062.00	48,436.00
Total transport of freights (thousands of tonnes)	23,231.37	29,499.04	0.0000	119,595.00

Table 1: Descriptive statistics

The mediation hypothesis proposed in this study is tested using the approach proposed by Surroca et al. (2010). This method consists of the implementation of a two-stage modelling strategy. All specifications are estimated by fixed-effects regression models. This modelling strategy helps overcome collinearity and endogeneity problems. By construction, the correlation between the estimated instruments and the mediating industry variables is low, thus preventing multicollinearity problems in model estimation (Wooldridge, 2008). The use of fixed-effects models controls for the potential endogeneity problems emerging from the correlation between the independent variables and the time-invariant region-specific unobserved heterogeneity. Additionally, all variables used in the model specifications (instruments, industry-related and control variables) are introduced as lagged terms ($t-1$) to avoid potential endogeneity problems linked to reverse causality.

4. RESULTS

This section presents the results of the empirical analysis. Additionally, results in Table 2 report the average variance inflation factor (VIF) for each regression. Results for this diagnostic test indicate that none of the models suffer from multicollinearity problems, as VIF values are below the commonly used cut-off threshold of ten.

Results in Model 1 of Table 2 provide evidence supporting Hypothesis 1. In particular this model does not consider the mediation of public instruments and show a positive and significant relation ($p < 0.05$) between the rate of new KIBS and employment enhancements in manufacturing firms. Additionally, results suggest that the KIBS’ regional firm formation rate positively impacts the stock of manufacturing firms and the total number freights transported (not shown in Table 2). This is a first necessary condition for testing the mediation effect of the policy instruments. Results in Model 2 of Table 2 show that the mediation of the industry configuration variables is strong. More concretely, the coefficient of the rate of new KIBS formation becomes insignificant whereas the parameters linked to stock of manufacturing firms and freights transported has a positive effect on the regional rate of new KIBS businesses ($p < 0.05$).

	Average employment creation in manufacturing firms	
	(1)	(2)
Rate of new KIBS firms ($t-1$)	0.3613** (0.1491)	0.3969 (0.3846)
Stock of manufacturing firms ($t-1$)		1.6773** (0.8499)
Freights transported (thousands of tonnes) ($t-1$)		0.1825** (0.0842)
Unemployment rate ($t-1$)	0.0894 *** (0.0340)	0.0834*** (0.0191)
GDP per head ($t-1$)	2.3028 * (1.1958)	2.5368* (1.5233)
Time dummies	Yes	Yes
Intercept	-5.0678 (4.3868)	-3.4723 (2.4508)
R-square (within)	0.2637	0.3248
F-test	7.53***	9.90***
Average VIF	2.61	6.14
Observations	102	102

Robust standard error is in brackets. *, **, *** indicate significance at the 10%, 5% and 1%, respectively.

Table 2: Fixed effects regression results: Mediation effects

5. CONCLUSIONS

This research provides evidence about the relevance of Knowledge Intensive Service Business (KIBS) on enhancing new manufacturing development. This is an important contribution to servitization literature, silent on the implementation of advanced services on new or small companies. This result offers 2 important recommendations for small and medium manufacturers:

- Location decision is important since local ecosystem and infrastructure determines at a high extent the conditions for firm sustainability.
- Outsourcing the service function to KIBS is strategically optimal when the company does not have enough experience and internal resources.

This research also has a policy orientation and provides relevant insights. The results demonstrate that the relation between KIBS and new manufacturers depends on two important policy instruments: stock of firms and frights transported. This gives a clear indication that policy makers must assure the development of appropriate infrastructures and business environment. However, Future research avenues on servitization in SMEs need to shed light on other issues, responding in particular to the following questions:

- Are there any other policy instruments (i.e. technology or cluster policy) that stimulate sertvitization in SMEs?
- Which are the elements that form the relation between manufacturers and KIBS?

REFERENCES

- Andersson, M. and Lööf, H. (2011) 'Agglomeration and productivity: evidence from firm-level data', *Annals of Regional Science*, vol. 46, pp. 601-620.
- Aranguren, M.J., Maza-Aramburu, X., Parrilli, D., Vendrell-Herrero, F. and Wilson, J. (2014) 'Nested Methodological Approaches for Cluster Policy Evaluation: An Application to the Basque Country', *Regional Studies*, vol. 48, no. 9, pp. 1547-1562.
- Arnold, J.M., Javorcik, B., Lipscomb, M. and Mattoo, A. (2014) 'Services Reform and Manufacturing Performance: Evidence from India', *The Economic Journal*, in press, <http://dx.doi.org/10.1111/econj.12206>
- Baines, T., Lightfoot, H., (2013) 'Made to Serve: How Manufacturers Can Compete through Servitization and Product Service Systems'. John Wiley & Sons, Hoboken, NJ.

- European Commission (2011) *Meeting the challenge of Europe 2020: The transformative power of service innovation*, Report by the Expert Panel on Service Innovation in the EU.
- Lessard, L. (2014) 'Designing and managing value co-creation in KIBS engagement', *Technology Innovation and Management Review*, vol. 4, no. 7, pp. 36-43.
- Magro, E. and Wilson, J. (2013) 'Complex innovation policy systems: towards an evaluation mix', *Research Policy*, vol. 42, no. 9, pp. 1647-1656.
- Matthyssens, P. and Vandenbempt, K. (2008) 'Moving from basic offerings to value-added solutions: Strategies, barriers and alignment', *Industrial Marketing Management*, vol. 37, pp. 316-328.
- Munnell, A.H. (1992) 'Policy infrastructure investment and economic growth', *The Journal of Economic Perspectives*, vol. 6, no. 4, pp. 189-198.
- Neely, A. (2008) 'Exploring the financial consequences of the servitization of manufacturing', *Operations Management Research*, vol. 1, no. 2, pp. 103-118.
- O'Cass, A. and Ngo, L.V. (2011) 'Examining the Firm's Value Creation Process: A Managerial Perspective of the Firm's Value Offering Strategy and Performance', *British Journal of Management*, vol. 22, pp. 646-671.
- Opresnik, D. and Taisch, M. (2015) 'The value of big data in servitization', *International Journal of Production Economics*, in press, doi:10.1016/j.ijpe.2014.12.036.
- Parrilli, D. and Elola, A. (2012) 'The strength of science and technology drivers for SME innovation', *Small Business Economics*, vol. 39, pp. 897-907.
- Reynolds, P., Bosma, N., Autio, E., Hunt, S., De Bono, N., Servais, I., Lopez, P. and Chin, N. (2005) 'Global Entrepreneurship Monitor: Data collection design and implementation 1998-2003', *Small Business Economics*, vol. 24, pp. 205-231.
- Rodrigue, J.P., Comtois, C. and Slack, B. (2013) *The Geography of Transport Systems*, New York: Routledge (3rd edition).
- Smith, L., Maull, R. and Ng, I. (2014) 'Servitization and operations management: A service dominant-logic approach', *International Journal of Operations and Production Management*, vol. 34, no. 2, pp. 242-269.
- Spohrer, J. and Maglio, P.P. (2008) 'The Emergence of Service Science: Toward Systematic Service Innovations to Accelerate Co-Creation of Value', *Production and Operations Management*, vol. 17, no. 3, pp. 238-246.
- Surroca, J., Tribó, J. and Waddock, S. (2010) 'Corporate Responsibility and Financial Performance: The Role of Intangible Resources', *Strategic Management Journal*, vol. 31, pp. 463-490.
- Teece, D.J. (1980) 'Economies of scope and the scope of the enterprise', *Journal of Economic Behavior & Organization*, vol. 1, pp. 223-247.
- Teece, D.J. (2010) 'Business models, business strategy and innovation', *Long Range Planning*, vol. 43, no. 2-3, pp. 172-194.
- Vandermerwe, S. and Rada, J. (1989) 'Servitization of business: adding value by adding services', *European Management Journal*, vol. 6, no. 4, pp. 314-324.
- Wooldridge, J.M. (2008) *Econometric Analysis of Cross Section and Panel Data*, Cambridge, Massachusetts: The MIT Press (2nd edition).

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